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# Gender Trends in Authorship of Gastroenterology Randomized Controlled Trial Literature

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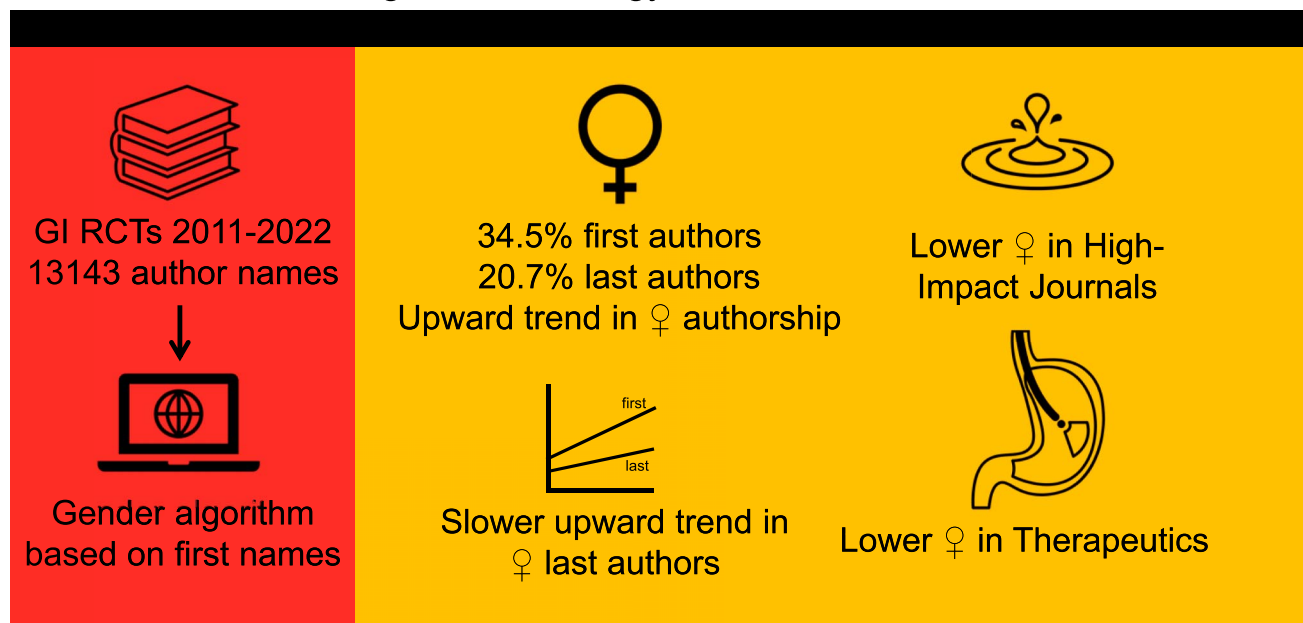
**INTRODUCTION:** We describe female authorship trends in gastroenterology (GI) randomized controlled trial literature as a novel focus on gender bias in academic GI.

**METHODS:** Using a systematic PubMed search, we extracted GI randomized controlled trial reports published from 2011 to 2022. We describe time trends in proportions of females among first and last authors overall and within GI subspecialties and high-impact journals.

**RESULTS:** The proportion of females increased from 25.4% to 36.8% and from 14.3% to 24.8% among first and last authors, respectively. Smaller increases in female authorship occurred in most subgroups, although there were proportionately fewer females among authors in high-impact journals and advanced therapeutic endoscopy publications.

**DISCUSSION:** Over the past decade, female authorship in GI RCT reports has increased. However, female representation, particularly among senior authors and in high-impact journals, remains significantly lower. Despite recent improvements, female still constitutes a minority of the authors of original GI RCTs.

## Gender trend in the gastroenterology randomized controlled trial literature



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## INTRODUCTION

Although strides have been made to reduce gender disparities in higher education, a discernible sex difference in professional advancement in academia remains. Gastroenterology (GI) continues to lack female representation, with women comprising only 19.7% of practicing gastroenterologists in the United States in 2021 (1). Within academic medicine, authorship order carries weight for professional advancement; by convention, the first author is the lead investigator, and the last author is the senior investigator (2). Because randomized controlled trials (RCTs) have scientific prestige, the proportion of females among RCT report authors is a useful metric for examining gender trends in professional advancement among academic gastroenterologists.

We examined gender trends in authorship of GI RCT reports from 2011 through 2022, stratified by author seniority, GI subspecialty, and journal impact. Although reports of gender trends in GI literature have been published (3,4), our search did not reveal any that focused on RCT publications worldwide.

## METHODS

We performed a systematic PubMed search for GI RCT reports published from January 1, 2011, through December 31, 2022. We used key terms to identify RCT publications in major GI subspecialties (hepatology, inflammatory bowel disease, and advanced therapeutic endoscopy [ATE]) (Appendix I, Supplementary Digital Content 1, <http://links.lww.com/AJG/D297>).

Using Python 3.8.12, we extracted relevant article information. We classified authors' gender with Genderize.io, an interface that uses more than 114 million first names to estimate the probability that a name corresponds to female or male gender (5). For names with a gender probability below 70%, we searched institutional websites to determine the authors' gender, classifying it as "unknown" if the gender was not apparent.

## Statistical analysis

We estimated the proportion of females among first authors and last authors by publication year overall and within subgroups: hepatology; inflammatory bowel disease; ATE; and high-impact journals (defined by top 10 general and GI journals, ranked by 2022 impact factors) (see Supplementary Digital Content 1, Appendix II, <http://links.lww.com/AJG/D297>). We categorized single authors as last authors. We used 2-sample tests of proportions and Royston's STATA 17 module for the Cochran-Armitage test of trend and test of departure from linearity (6).

## RESULTS

Our search identified 6,573 GI RCT reports, with 6,573 last authors and 6,570 first authors. We classified gender for 99.4% of authors. The average probability of a correct gender match was 93% across all authors; 95.3% had a gender probability over 70%. We manually classified 4.1% and excluded 0.6% with unknown

gender. Overall, 34.5% of first authors and 20.7% of last authors were female (Table 1). The proportion of females increased from 25.4% in 2011 to 36.8% in 2022 (trend  $P$  value <0.001) among first authors and from 14.3% in 2011 to 24.8% in 2022 (trend  $P$  value <0.001) among last authors (Figure 1; Table 1 and see Supplementary Digital Content 1, Appendix III, <http://links.lww.com/AJG/D297>).

Comparing 1,971 high-impact GI RCT reports to all GI RCT reports, the proportion of females was 5.9% points lower ( $P$  value <0.001) among first authors and 4.1% points lower ( $P$  value <0.001) among last authors. Among high-impact publications over the study period, there was no significant increase in the proportion of female among last authors (average 0.32%-point decrease per year, trend  $P$  value = 0.26), and a slow upward trend among first authors (+0.90% per year; trend  $P$  value <0.001), while fluctuating in an irregular, nonlinear manner (departure from linearity  $P$  value <0.001).

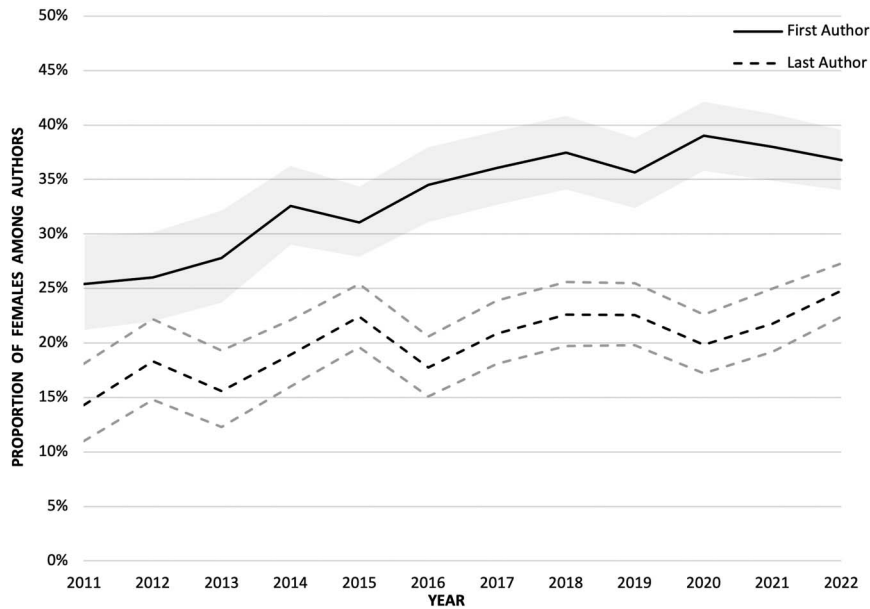
Examination of subspecialty authorship revealed larger gender disparities relative to all GI RCTs (Table 2). Most notably, the proportion of females in the ATE subgroup was 8.5% points lower among first authors ( $P$  value <0.001) and 4.8% points lower among last authors ( $P$  value <0.001) (Table 2). Trend analysis results for subspecialties are shown in Appendix III (see Supplementary Digital Content 1, <http://links.lww.com/AJG/D297>).

## DISCUSSION

Over the past decade, there has been an upward trend in female authorship of GI RCT reports. However, the increase in the proportion of females among authors slowed toward the end of

**Table 1.** Number and proportion of males and females among first and last authors of gastroenterology randomized controlled trial reports published from 2011 through 2022 by year

Year	First author				Last author			
	Male		Female		Male		Female	
	n	%	n	%	n	%	n	%
2011	220	74.6	75	25.4	252	85.7	42	14.3
2012	242	74.0	85	26.0	263	81.7	59	18.3
2013	231	72.2	89	27.8	271	84.4	50	15.6
2014	321	67.4	155	32.6	386	81.1	90	18.9
2015	406	68.9	183	31.1	457	77.6	132	22.4
2016	359	65.5	189	34.5	450	82.3	97	17.7
2017	365	63.9	206	36.1	448	79.2	118	20.8
2018	359	62.5	215	37.5	445	77.4	130	22.6
2019	397	64.3	220	35.7	477	77.4	139	22.6
2020	400	61.0	256	39.0	526	80.2	130	19.8
2021	431	62.0	264	38.0	543	78.2	151	21.8
2022	553	63.2	322	36.8	661	75.2	218	24.8



**Figure 1.** Trends in the proportion of females among first and last authors of gastroenterology randomized controlled trial reports published from 2011 through 2022 with 90% confidence limits.

the study period, raising uncertainty about whether the proportion will continue to rise. Similar trends have been noted in other medical fields (7–12), indicating a persistent lack of gender parity despite increasing female representation over time. In a recent US study, women accounted for only 25.5% of academic gastroenterologists (8). The gap in female authorship is in part, likely an indirect reflection of the overall underrepresentation of women in academic GI and GI as a field.

The average rate of increase in female representation among last authors was lower and less steady relative to first authors and stagnant across examined subspecialties. Moreover, female representation in both author groups was substantially lower in high-impact journal GI RCT reports than all GI RCT reports with no increase over time in this subgroup. Studies of general GI publications similarly revealed a slower increase in female representation among last authors relative to first authors (3,4), with women accounting for less than 25% of academic gastroenterologists (13). According to a recent study, although first authorship in GI journals is approaching gender parity, senior authorship and editorial board

positions continue to be male-dominated (14). Furthermore, of the GI subspecialties examined in our study, ATE had the lowest proportion of female authors, a proportion that remained unchanged through the past decade. Previous research also shows the lack of growth in female authorship in ATE over the preceding decade and inferior female representation in fellowships in the United States (15).

The main limitation of this study is the classification of gender based on first names. Although Genderize.io uses vast data to match names and genders, Genderize.io only assigns binary genders, which may misclassify some authors. In addition, given the study design, we were unable to discern other factors contributing to the gender gap, along with potential barriers that may reduce the pool of female senior faculty members eligible for prominent roles. Further research is needed to assess the social and professional implications of the observed gender gap and explore variations of female participation by geographic areas.

Overall, despite increases in female authorship over the past decade, there is a gender gap present within GI RCT publications.

**Table 2.** Proportion of females among authors by GI subspecialty and journal impact published from 2011 through 2022 and difference in this proportion relative to all GI RCT reports published during this period

	First author				Last author			
	n	Female (%)	Proportion difference (%)	P value	n	Female (%)	Proportion difference (%)	P value
All	6,543	34.5	Referent	Referent	6,535	20.7	Referent	Referent
Hepatology	1,287	32.4	-2.1	0.15	1,288	17.5	-3.2	<0.01
IBD	687	30.3	-4.2	0.027	687	21.7	+1.0	0.54
Therapeutics	2,067	26.0	-8.5	<0.001	2,065	15.9	-4.8	<0.001
High impact	1,971	28.6	-5.9	<0.001	1,972	16.6	-4.1	<0.001

GI, gastroenterology; IBD, inflammatory bowel disease; RCT, randomized controlled trial.

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**CONFLICTS OF INTEREST**

**Guarantors of the article:** Crystal S. Liu, MD, and Karen I. Kroeker, MSc, MD.

**Specific author contributions:** C.L. and K.K.: planning and conducting the study. C.L. and Z.L.: collecting data. C.L., T.C., and K.G.: statistical analysis. C.L., T.C., and K.G.: interpreting data. C.L. and T.C.: drafting the manuscript.

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**Potential competing interests:** None to report.

**Study Highlights****WHAT IS KNOWN**

- ✓ Women constitute an increasing proportion of scholars in academic medicine.

**WHAT IS NEW HERE**

- ✓ Increase in female authorship over the past decade in gastroenterology RCT publications.
- ✓ Slower rate of increase in the proportion of authors who were female observed for last authors relative to first authors.
- ✓ No increase in the proportion of female senior authors among all authors in the higher-impact journal subgroup.

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